

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-2 (Cancelled).

Claim 3 (Currently Amended): The method as recited in claim 7 [[1]] wherein the concentrations of the organic additives are selected such that the plating rate is greater than the electropolishing rate in a topography dependant fashion.

Claim 4 (Currently Amended): The method as recited in claim 7 [[1]] wherein the topography dependant fashion comprises increasing the rate of plating at corners of trenches or vias.

Claim 5 (Cancelled).

Claim 6 (Currently Amended): The method as recited in claim 7 [[1]] wherein the removal rate of electropolishing is controlled by one of adjusting the voltage applied to the electrodes in the electrolytic solution and the duration of the applied voltage.

Claim 7 (Currently Amended): A method of planarizing a metal layer on a semiconductor substrate, the method comprising:

forming a trench or via in a dielectric layer of the semiconductor substrate;

forming the metal layer on the dielectric layer such that the metal layer at least fills the trenches or vias;

immersing the substrate in an electrolyte plating solution having organic additives, the organic additives comprising at least one of plating accelerators, plating suppressors, and plating levelers; and

removing the excess portions of the metal layer by performing sequentially electropolishing followed by electroplating, wherein the polishing, plating, and relaxation operations comprise one cycle of a pass and wherein the method comprises at least two passes performed sequentially and wherein the relaxation operation is performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins.

Claim 8 (Currently Amended): The method as recited in claim 7 wherein the ratio of the electropolishing to electroplating rates in the first of the at least two passes is about 1.5 and the ratio of the ~~of the~~ electropolishing to electroplating rates in the last of the at least two passes is about 1.

Claim 9 (Original): The method as recited in claim 7 wherein the ratio of the electropolishing to plating rates in the first of the at least two passes is about 1.5 and the ratio of the of the electropolishing to electroplating rates in the last of the at least two passes is about 1, wherein the electropolishing to electroplating rates progressively decreases from the first to the last of the at least two passes.

Claim 10 (Currently Amended): The method as recited in claim 7 ~~[[1]]~~ wherein the organic additives comprises a plating accelerator having a concentration in the electrolyte in the range from 1 to 10 ml/liter.

Claim 11 (Currently Amended): The method as recited in claim 7 ~~[[1]]~~ wherein the organic additives comprises a plating suppressor having a concentration in the electrolyte in the range from 5 to 15 ml/liter.

Claim 12 (Currently Amended): The method as recited in claim 7 ~~[[1]]~~ wherein the organic additives comprises a plating leveler having a concentration in the electrolyte in the range from 1 to 5 ml/liter.

Claim 13 (Currently Amended): The method as recited in claim 7 [[1]] wherein the organic additives comprises a plating accelerator having a concentration in the electrolyte in the range from 1 to 10 ml/liter, and a plating suppressor having a concentration in the electrolyte in the range from 5 to 15 ml/liter.

Claim 14 (Currently Amended): The method as recited in claim 7 [[1]] wherein the organic additives comprises a plating accelerator having a concentration in the electrolyte in the range from 1 to 10 ml/liter, a plating suppressor having a concentration in the electrolyte in the range from 1 to 5 ml/liter, and a plating leveler having a concentration in the electrolyte in the range from 1 to 5 ml/liter.

Claim 15 (Currently Amended): The method as recited in claim 7 [[2]] wherein the electropolishing and electroplating is performed using a nozzle configured to spray the wafer and to move from the wafer center to the wafer edge in a pass.

Claim 16 (Currently Amended): The method as recited in claim 7 [[2]] wherein the electropolishing and electroplating is performed using a wafer-wide polisher.

Claims 17-20 (Cancelled).

Claim 21 (Currently Amended): A method of planarizing metal on a semiconductor substrate, the method comprising:

- providing a semiconductor substrate having a trench or via formed in a dielectric layer of the substrate;
- filling the trenches and vias with a metal layer;
- spraying the substrate with a coating of electrolyte plating solution having organic additives, the organic additives comprising at least one of plating accelerators, plating suppressors, and plating levelers;

planarizing the metal layer to compensate for excessive trench corner polishing by implementing a series of pulses comprising sequential electropolishing followed by electroplating and relaxation,

the electropolishing being conducted such that that localized polishing rates inside the trenches at the corners of the trenches are greater than the localized polishing rates in the middle of the trenches resulting in a metal removal profile that removes metal at greater rate at the corner of the trenches relative to a metal removal rate in the middle of the trenches;

the electroplating being conducted such that localized plating rates inside the trenches at the corners of the trenches are greater than the localized plating rates in the middle of the trenches resulting in a metal deposition profile having a thicker metal layer at the corner of the trenches relative to the metal layer in the middle of the trenches;

the relaxation operation being conducted in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins.

and

the series of pulses being implemented such that the pulses begin with a polishing rate/plating rate ratio of greater than 1 and wherein as the series of pulses continue said ratio decreases to about 1 as the metal layer is planarized to its final profile.

Claim 22 (Previously Presented): The method as recited in claim 21 wherein in the initial pulse the electropolishing rate/electroplating rate ratio is about 1.5 and the ratio of the of the electropolishing to electroplating rates in the last of the at least two passes is about 1.

Claim 23 (Previously Presented): The method as recited in claim 21 wherein the ratio of the electropolishing to plating rates begins at about 1.5 and the ratio of the of the electropolishing to electroplating rates in the last of the pulses is about 1, wherein the ratio of electropolishing to electroplating rates progressively decreases from the 1.5 to 1.

Claim 24 (Cancelled).

Claim 25 (Previously Presented): The method as recited in claim 21 wherein the organic additives include bis (3-sulfopropyl) disulfide.

Claim 26 (Previously Presented): The method as recited in claim 4 wherein the organic additives include bis (3-sulfopropyl) disulfide.

Claim 27 (New): A method of planarizing a metal layer on a semiconductor substrate, the method comprising:

providing a semiconductor substrate having a trench or via formed in a dielectric layer of the semiconductor substrate;

forming the metal layer on the dielectric layer such that the metal layer at least fills the trenches or vias;

immersing the substrate in an electrolyte plating solution having organic additives, the organic additives comprising at least one of plating accelerators, plating suppressors, and plating levelers; and

executing a series of cycles for removing the excess portions of the metal layer wherein said cycles include performing sequentially electropolishing followed by electroplating and equilibrating the electrolyte plating solution wherein the equilibration is performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins.

Claim 28 (New): The method of Claim 27 wherein said equilibrating of the electrolyte plating solution comprises locally equilibrating the electrolyte plating solution near the metal later on the trench or via being planarized, said equilibration taking into consideration the diffusion coefficients for the additives.